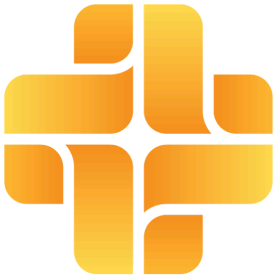
# Infant and Maternal Mortality & Morbidity in the Black Community:

## A Scoping Review

**prepared for**



GRAND RAPIDS
African American
Health Institute

Holly C. VanScoy, Ph.D.
Academic Research Associates

January 2024

*The legacies of slavery today are seen in structural racism that has resulted in disproportionate maternal and infant death among African Americans. The deep roots of these patterns of disparity in maternal and infant health lie with the commodification of enslaved Black women's childbearing and physicians' investment in serving the interests of slaveowners. Even certain medical specializations, such as obstetrics and gynecology, owe a debt to enslaved women who became experimental subjects in the development of the field. Public health initiatives must acknowledge these historical legacies by addressing institutionalized racism and implicit bias in medicine while promoting programs that remedy socially embedded health disparities.*

**Deirdre Cooper Owens, PhD, and Sharla M. Fett, PhD, 2019**

# Infant and Maternal Morbidity & Mortality in the Black Community: A Focused Scoping Review

Holly C. VanScoy, Ph.D.

## INTRODUCTION

There is considerable scientific evidence about the many disparities between the pregnancy and birth outcomes for women and infants who are Black and those outcomes for women who are not. For some seven decades, studies have examined these disparities worldwide, throughout the United States, and within Michigan, including Kent County, the state's fourth-largest county by population and the location of Grand Rapids, the state's second-largest city.

The purpose of this scoping review is to provide to the Grand Rapids African American Health Institute (GRAAHI) in Kent County, Michigan, a concise summary of the most cogent, recent data on the pregnancy outcomes experienced by Black families, for use in the organization's future program development, policy advocacy, and partnership development activities directed at eliminating the often stark differences in maternal and infant outcomes that continue to adversely impact local Black individuals, families, neighborhoods, and Kent County as a whole.

### About scoping reviews

As Munn et al. (2018) noted, in contrast to systematic reviews that require significant time, resources, and personnel, scoping reviews utilize a quick gathering of literature to provide an overview of the range and depth of research that exists on a topic of clinical, scholarly, or practical interest. Scoping reviews can identify key concepts, theories, and sources of evidence and can be a first step in conducting systematic reviews because they allow researchers to see where there are data points within the larger literature landscape. They can also highlight potential research gaps and future research needs, as well as exploring a topic broadly, rather than answering specific questions. Scoping reviews can also reveal the organizations and individuals most active in or relevant to a domain of interest and what those parties have studied and published in a field. Such results can also be used used to justify further investigations, including the investment of additional time and fiscal resources to explore the most interesting or potentially useful data obtained.

## Design of the review

This review was designed and implemented solely by Holly C. VanScoy, Ph.D., in response to a request from Vanessa Greene, CEO of The Grand Rapids African American Health Institute (GRAAHI), for "a study on infant and maternal health for Black people."[1]

A preliminary scan of the literature related to infant and maternal health—with an intentional focus on the birth outcomes of Black women in the United States, Michigan, and Kent County—was conducted from October 21, 2023, through December 20, 2023, inclusive, using: the U.S. National Institutes of Health National Library of Medicine accessed via PubMed[2]; the Cochrane Library[3]; the U.S. National Institutes of Health Office of Research on Women's Health website[4]; the Michigan Department of Health website[5]; the Kent County Health Department website[6]; and Google search engine results. In addition, after the preliminary scan, further analysis consisted of the "2023 March of Dimes Report Card: The state of maternal and infant health for American families"[7], released on November 16, 2023, as well as the 2022 Report Card and the "Vital Statistics Rapids Release, Report 33: Infant mortality in the United States: Provisional data"[8], published by the National Center for Health Statistics on November 10, 2023. All materials were accessed online.

The terms *infant mortality*, *maternal mortality*, *pregnancy-related death*, *maternal and infant death*, *maternal and infant morbidity*, *severe maternal morbidity*, i*nfant and maternal health disparities*, *Black infant health*, *Black maternal health*, and *racial disparities in birth outcomes* were used as key words in online searches including through Google, PubMed, and other specialized online medical databases.

## Definition of terms

[1] Email communication of October 19, 2023, from Vanessa Greene, GRAAHI CEO, to Holly VanScoy, Ph.D.
[2] PubMed® comprises more than 36 million citations for biomedical literature from MEDLINE, life science journals, and online books. Available at: https://pubmed.ncbi.nlm.nih.gov/.
[3] The Cochrane Library is a collection of databases in medicine and other healthcare specialties, including Cochrane Reviews, a database of systematic reviews and meta-analyses that summarize and interpret the results of medical research, including research on maternal and infant health Available at: https://www.cochranelibrary.com/?contentLanguage=eng.
[4] U.S. Institutes of Health Office of Women's Health. Available at: https://orwh.od.nih.gov/.
[5] Michigan Department of Health and Human Services, Maternal and Child Health Data, Maternal Child Health Epidemiology Section. Available at: https://www.michigan.gov/mdhhs/adult-child-serv/childrenfamilies/mchepi.
[6] Kent County, Michigan, Health Department. Pregnancy & Parenting Support Services. Maternal and Infant Health. Available at: https://www.accesskent.com/Health/PregnancyParenting/health.htm
[7] The annual March of Dimes "Report Card" highlights the collective factors that contribute to maternal and infant mortality across the United States, including state rankings on key indicators of maternal and infant health. Available at: https://www.marchofdimes.org/report-card.
[8] The National Center for Health Statistics annually prepares provisional (preliminary) reports known as Vital Statistics Rapid Release documents on standardized health indicators in each state. The report analyzed for this scoping review is the provisional report on infant mortality data from 2022.

This search strategy returned a large number of peer-reviewed studies and scientific reports published since 2017 on *maternal mortality*, defined by the World Health Organization (WHO) as "the death of a woman while pregnant or within 42 days of the termination of her pregnancy, irrespective of the duration and site of the pregnancy, from any cause related to or aggravated by the pregnancy or its management, but not from accidental or incidental causes," as well as many studies of *pregnancy-related death*, similarly, but not identically, defined by the U.S. Centers for Disease Control and Prevention (CDC) as "the death of a woman while pregnant or within one year of the end of the pregnancy—regardless of the outcome, duration, or site of the pregnancy—from any cause related to or aggravated by the pregnancy or its management, but not from accidental or incidental causes."

The preliminary search also identified a large number of studies and reports using the WHO definition of *maternal morbidity*: "any health condition attributed to and/or aggravated by pregnancy and childbirth that has a negative impact on the woman's wellbeing," and hundreds more using the CDC's definition of *severe maternal morbidity* (SMM) as "including unexpected outcomes of labor and delivery that result in significant short- or long-term consequences to a woman's health."

Within this literature, *infant mortality* was uniformly defined as "the death of an infant before reaching the age of one year," and the *infant mortality rate* was generally standardized as "the number of deaths for every 1,000 live births in the population(s) of interest."

**Preliminary Findings**

A very significant number and extremely wide topical range of published (peer-reviewed) and unpublished but well-designed studies, meta-analyses of studies, and numerous reports about Black women during their preconception, pregnancy, and postpartum periods, and about their infants at birth and during their first year of life were identified for potential analysis in the initial searches. For example, utilizing the PubMed search engine to access the MEDLINE database of references and abstracts on life science and biomedical topics in the U.S. National Library of Medicine, the initial search for m*aternal mortality in the U.S.* on October 19, 2023, returned 9,474 results, the earliest of these from September 1924, a century ago.[9]

The search for *black infant health* returned 8,492 results and *black maternal health* returned 5,597 (many identical), with the earliest study returned for both searches dating to October 1946.

Using *maternal and infant health disparities* as the search term returned 2,772 PubMed citations (some identical to those previously returned), the earliest dating to February 1969.

These results demonstrate that Black infant and maternal health have been of interest to the medical community for a century; however, even a cursory examination of this literature reveals that the disparities between maternal and infant mortality and morbidity in Black populations as opposed to those in other populations have been of interest only for about half of this period, with the majority published since 1970.

[9] There is no analysis of maternal mortality utilizing the race of the mother as an independent variable in this early study by Morse and Woodbury (1924), which reviewed maternal deaths from 1900 through 1921.

### The final scoping framework

Because of the very large number of studies and reports and the very short time available for their analysis by this project, a narrowed scoping timeframe was established limited both to the most recent studies and reports and, principally, to those that provide information on disparate outcomes for Black mothers and their infants compared to mothers and infants of other racial or ethnic backgrounds, as well as studies and reports describing evidence-based approaches to reduce or eliminate the disparate outcomes Black mothers and their infants experience.

Due to the nature of the search results and data they provide, this review focuses on a summary of recent studies and reports—most of them published from January 2019 through November 2023. Each study or report examined contained evidence either on Black infant mortality or morbidity, Black maternal mortality or morbidity, and/or on interventions purported to meaningfully reduce or have the potential to meaningfully reduce the disparity between the rates of Black infant and maternal morbidity and mortality and such rates in other racial and ethnic populations.

In addition, although there is considerable recent (and potentially relevant) evidence on infant and maternal mortality and morbidity from global sources, including the 54 countries in Africa where Blacks comprise the majority population and countries in South America with large Black populations, the literature examined was confined to studies and reports in which data was collected in the United States and the data from Black mothers and/or infants was separately analyzed and reported. This focus also intentionally oversampled studies and reports analyzing data on maternal and infant outcomes collected about maternal and infant outcomes in Michigan, and/or Kent County and/or Grand Rapids, Michigan, where GRAAHI is located.

The final analysis of the information and data was conducted between November 5 and December 15, 2023; this report written between December 15, 2023, and January 2, 2024.

## REVIEW FINDINGS

### Birth rates

The *number* of infant deaths is linked inextricably to the number of live infant births, unlike the infant mortality *rate*, which is indexed to allow comparison across different time periods. It is most useful to consider rates of birth as a context for understanding infant mortality.

According to the United Nations "World Population Prospects" (2022), 103,600,000 infants were born worldwide in 2020, continuing decline of global birth rate that began in 1971. A similar trend is documented in the United States where 3.49% of the world's infants were born in 2020. According to Osterman et al. (2022) a total of 3,613,647 births were registered in the United States in 2020, down 4% from 2019. **Some 529,811 of those—comprising 14.7% of all U.S. births in 2020—were to non-Hispanic, single-race Black (Black) women.** That proportion

(14.7%) of Black infants born in 2020 was 2.3% higher than the proportion of Blacks in the U.S. population that year.[10]

Among women of different races and Hispanic-origin groups, the total number of births declined 2% for Hispanics, **3% for Blacks**, and 4% for Whites from 2019 to 2020, with even larger declines reported in births for Alaskans and American Indians (6%) and Asians (8%). The general fertility rate nationwide declined to 56.0 births per 1,000 women aged 15 to 44 in 2020, a new record low for the nation, **with the fertility rates for both Black and White women declining 4%.**[11]

**In 2020, Michigan** women gave birth to 104,074 infants, **19,341 (18.5%) of which were Black**. These Black infants represented a 6.1% greater proportion of Michigan newborns than the 12.4% of the state population that Blacks comprised that year.

Of those Michigan infants born in 2020, 8,166 were delivered in Kent County, comprising 7.84% of the state's total births that year. In 2021, 8,195 of Michigan's 105,022 newborns were delivered in Kent County, comprising a similar 7.80% of the state's total births.

**In 2021, 1,069 (13.4%) of Kent County's newborns were Black**. Black infants comprised a larger proportion of Kent County's newborns than the 10.8% of the total population Blacks comprised countywide that year.

**In the City of Grand Rapids**, the county seat and largest city of Kent County, Michigan, the three-year average number of live births from 2019 through 2021 was 2,945.3. Of these newborns, **741.7 (25.2%) were born to Black mothers**. Black infants comprised a significantly greater proportion of Grand Rapids' newborn cohort during this period than the total Black proportion of the city, which was 18.4% in 2020.

**Infant mortality**

After nearly two decades of steady decline, the U.S. infant death rate increased by 3% in 2022,[12] particularly for infants born to mothers aged 25 to 29, those born prematurely, male infants, and infants born in Georgia, Iowa, Missouri, and Texas. **Black infants had the highest overall rates of infant mortality nationwide.** Some 20,538 infants born in the United States died before their first birthdays in 2022, a (provisional) infant mortality rate of 5.6 infant deaths per 1,000 live births. Nationally, the neonatal (< 28 days old) mortality rate in 2022 was 3% higher than in 2021, and the 2022 post-neonatal (28 to 364 days old) mortality rate was 4% higher than 2021.

As shown in Figure 1, although the mortality rate for infants of Black women did not increase significantly from 2021 to 2022, **Black infants had the highest overall mortality rates in 2021**

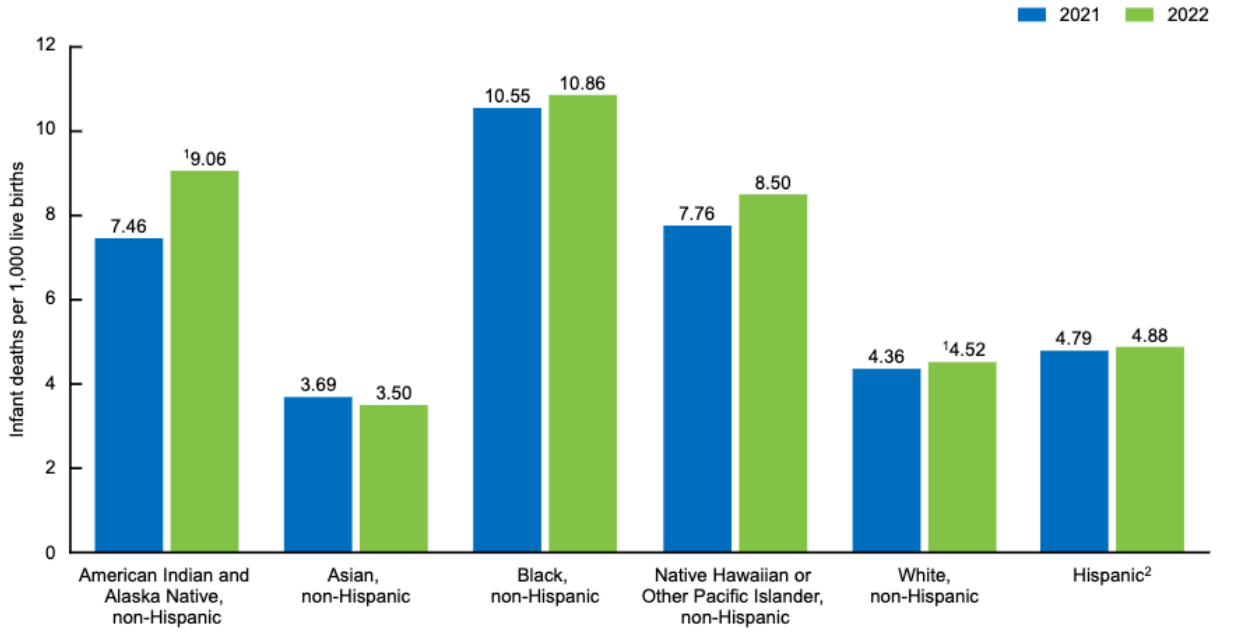
[10] In the 2020 U.S. Census, 41,104,200 U.S. residents identified as non-Hispanic African American or Black, comprising 12.4% of the nation's 331,449,281 total population.

[11] *Fertility rate* refers to the number of live births that occur each year among women of childbearing age between 15 and 44 years old. The 2020 fertility rate was about half of the U.S. fertility rate in the early 1960s.

[12] The impact of the COVID pandemic on infant and maternal mortality and morbidity remains under study. It is widely suspected that the SARS-CoV-2 virus played a role in the increases reported. See Chmielewska.

**(10.55 deaths per 1,000 births) and 2022 (10.86 deaths per 1,000 births).** In both years, the infant mortality rate for infants born to Black women was more than twice that of infants born to White women.

Figure 1. Infant mortality rate by race and Hispanic origin, U.S., 2021 (final) and 2022 (provisional)




The infant mortality rate in Michigan is similar: in 2021, there were 104,980 infants born in Michigan, 653 of whom died before their first birthday, an infant mortality rate of 6.22 per 1,000 live births. In 2022, there were 102,321 infants born statewide, 657 of whom died during the first year of life, an infant mortality rate of 6.42 per 1,000 live births, and a 3.2% increase in infant mortality over the previous year

According to the most recent Fetal Infant Mortality Review conducted by the Kent County Health Department (Brown et al. 2022), although the average infant mortality rate in Michigan between 2010 and 2020 was relatively stable at about 7 deaths per 1,000 live births, in 2020 **Black infants had the highest rates of mortality: they were 2.8 times more likely to die than White infants statewide**.

Brown et al. (2022) also reported **the Black infant mortality rate in Kent County was significantly higher than the White infant mortality rate throughout the decade from 2010 through 2020:** In 2010-2012, **a Black infant in Kent County was 3.3 times more likely to die than a White infant. Although the disparity decreased to 2.4 by 2012-2014, it had risen again to 2.7 by 2018-2020**.

The three-year moving average of infant mortality rates in the City of Grand Rapids began at just under 9.0 deaths per 1,000 live births in 2010-2012 and dropped to slightly above 5.0 by 2018-2020, similar to the rate reported statewide. A comparison of the three-year moving

average rate of infant mortality for Blacks and Whites in Grand Rapids shows that although rates for both groups dropped between 2010 and 2020, **the rate for the City's Black infants remained twice as high as the rate for White infants throughout the decade.**

**Characteristics of Kent County parents whose infants died**

The Kent County Fetal Infant Mortality Case Review Team analyzed 180 of the 244 infant deaths that occurred from 2015 through 2020 (Brown et al. 2022). The following information about the demographic characteristics of the birthing mother and the infants' father was reported:

- 30% the mothers whose infants died were between 25-29 years old. Asian mothers (16.7%) and Hispanic mothers (16%) were the most likely to give birth as teens; **Black mothers (22.9%) had the highest percentage of advanced maternal age (> 35 years old) births.** The majority of mothers (54.5%) identifying "Other" for their race were 20 to 24 years old.

- 85.6% of mothers were U.S. born; 14.4% were born elsewhere. Asian mothers (83.3%) and Hispanic mothers (48%) were most likely to be born outside of the United States.

- 31.1% of mothers had a healthy BMI of 18-24.9 while 65.6% were either overweight or obese. Asian mothers (50%), Hispanic mothers (48%), and **Black mothers (45.8%) had the highest proportions of obesity.**

- 57.8% of White mothers had a higher education (some college, bachelor's degree, or post-bachelor's degree), compared to **39.6% of Black mothers**, 24% of Hispanic mothers, and 0% of Asian mothers.

- 36.6% of White fathers had a bachelor's degree or higher compared to **8.5% of Black fathers** and 3.8% of Hispanic fathers.

- Hispanic mothers (72%), **Black mothers (56.3%),** Asian mothers (50%), and Other race mothers (54.5%) were more likely to receive Medicaid compared to White mothers (27.8%).[13]

- 63.3% of White mothers were married at the time of the infant's death, while 52% of Hispanic mothers, 50% of Asian mothers, and 27.3% of other race mothers, and **18.8% of Black mothers were married**.

[13] Previous research shows that Medicaid recipients are nearly twice as likely to experience severe maternal morbidity and mortality compared to women with private insurance.

- 38.9% of White infants were extremely preterm (< 28 weeks gestation) compared to 52% Hispanic infants and **45.9% of Black infants.** Asian mothers were the most likely to have a full-term birth (≥37 weeks gestation).

- 32.2% of infants born to White mothers weighed less than 750 grams **compared to** 48% of infants born to Hispanic mothers and **43.8% of infants born to Black mothers**.

**Characteristics of U.S. infants who died in their first year, 2021 & 2022**

Figure 2: U.S. Infant deaths, births, and infant mortality rates by selected characteristics, Final 2021 and Provisional 2022 (Ely & Driscoll, 2023)

| Characteristic | 2021 | | | 2022 | | | Percent change |
|---|---|---|---|---|---|---|---|
| | Deaths | Births | Rate[1] | Deaths | Births | Rate[1] | |
| Total | 19,928 | 3,664,292 | 5.44 | 20,538 | 3,667,758 | 5.60 | †3 |
| Age at death | | | | | | | |
| Neonatal[2] | 12,797 | 3,664,292 | 3.49 | 13,120 | 3,667,758 | 3.58 | †3 |
| Postneonatal[3] | 7,131 | 3,664,292 | 1.95 | 7,418 | 3,667,758 | 2.02 | †4 |
| Race and Hispanic origin | | | | | | | |
| Non-Hispanic: | | | | | | | |
| American Indian and Alaska Native | 195 | 26,124 | 7.46 | 233 | 25,721 | 9.06 | †21 |
| Asian | 788 | 213,813 | 3.69 | 767 | 218,994 | 3.50 | -5 |
| Black | 5,463 | 517,889 | 10.55 | 5,552 | 511,439 | 10.86 | 3 |
| Native Hawaiian or Other Pacific Islander | 74 | 9,531 | 7.76 | 86 | 10,122 | 8.50 | 10 |
| White | 8,236 | 1,887,656 | 4.36 | 8,311 | 1,840,739 | 4.52 | †4 |
| Hispanic | 4,246 | 885,916 | 4.79 | 4,578 | 937,421 | 4.88 | 2 |
| Maternal age | | | | | | | |
| Younger than 20 | 1,373 | 148,850 | 9.22 | 1,440 | 145,614 | 9.89 | 7 |
| 20–24 | 4,455 | 648,484 | 6.87 | 4,547 | 638,685 | 7.12 | 4 |
| 25–29 | 5,275 | 1,023,989 | 5.15 | 5,437 | 1,013,417 | 5.37 | †4 |
| 30–34 | 4,999 | 1,115,055 | 4.48 | 5,127 | 1,118,787 | 4.58 | 2 |
| 35–39 | 2,911 | 592,179 | 4.92 | 3,017 | 606,598 | 4.97 | 1 |
| 40 and older | 915 | 135,735 | 6.74 | 970 | 144,657 | 6.71 | 0 |
| Period of gestation (weeks)[4] | | | | | | | |
| Less than 37 | 12,896 | 383,979 | 33.59 | 13,201 | 380,548 | 34.69 | †3 |
| Less than 34 | 10,618 | 103,004 | 103.08 | 10,887 | 101,167 | 107.61 | †4 |
| Less than 28 | 8,323 | 23,527 | 353.76 | 8,487 | 23,369 | 363.17 | 3 |
| 34–36 | 2,278 | 280,975 | 8.11 | 2,314 | 279,381 | 8.28 | 2 |
| 37 or more | | | | | | | |
| 37–38 | 3,310 | 1,052,935 | 3.14 | 3,457 | 1,074,082 | 3.22 | 3 |
| 39–40 | 3,248 | 2,046,786 | 1.59 | 3,363 | 2,027,670 | 1.66 | 4 |
| 41 or more | 288 | 177,600 | 1.62 | 340 | 182,787 | 1.86 | 15 |
| Infant sex | | | | | | | |
| Female | 8,998 | 1,790,876 | 5.02 | 9,174 | 1,793,312 | 5.12 | 2 |
| Male | 10,930 | 1,873,416 | 5.83 | 11,364 | 1,874,446 | 6.06 | †4 |

†Significant change in rate from 2021 to 2022 ($p < 0.05$).
[1]Deaths per 1,000 live births.
[2]Deaths before 28 days per 1,000 live births.
[3]Deaths from 28 through 364 days per 1,000 live births.
[4]Gestational age based on the obstetric estimate.

SOURCE: National Center for Health Statistics, National Vital Statistics System, linked birth/infant death file.

The characteristics of U.S.-born infants who died before reaching their first birthdays in 2021 and 2022 are shown in Figure 2 above and are disaggregated by the infants' age at death, race,

and Hispanic origin, age of their mothers, period of gestation, and sex. This information is final for 2021 and provisional for 2022 (Ely & Driscoll 2023).

As shown, the total **number of births and deaths both increased slightly in this two-year period, as did the total number of Black infants who were born and died in these years.** Note that the overall percentage change in the infant mortality rate for all populations **and for Blacks is 3%**, a statistically significant change (p = <0.05) for both groups.

Note, also in Figure 2, that the infant death rate for infants of all races nationwide increased from 5.44 to 5.80 per 1,000 live births in the two-year period, while **the rate for Black infants increased from 10.55 to 10.86 per 1,000 live births in the period. These most recent infant mortality figures confirm that the disparity between the infant death rates of Black and White infants in the U.S. has remained constant.**

**The Michigan infant mortality rate**

According to a recent State of Michigan analysis (Meyers 2023), in 2021 some 656 infants under the age of one died statewide, resulting in an overall infant mortality rate of 6.2 per 1,000 live births, an historic low and the basis for the Michigan Department of Health & Human Services projection that "the 2021 infant death rate of 6.2 may be indicative of a long-term, very gradual decline in the infant death rate."

That analysis also notes ". . . a persistant [sic] racial disparity in which **African American mothers experienced over three times the risk of an infant death compared to white mothers.**" It adds: "[b]etween 2011-2015, the white infant death rate was an average of 5.3 deaths per 1,000 white births; between 2016-2020, the rate slightly declined to 4.8. In 2021, the white infant death rate fail [sic] to a historic low of 4.2. **The black infant mortality rate showed no declines during the same period. Between 2011-2015, the black infant mortality rate was an average of 13.6 infant deaths per 1,000 black births; between 2016-2020, the average rate slightly increased to 14.1. In 2021, the black infant death rate was 15.5."**

**Causes of Infant Death in the U.S. & Michigan, 2021 and 2022**

Figure 3: Recent U.S. Infant Deaths and Infant Mortality Rates, Final 2021 and Provisional 2022 (Ely & Driscoll 2023)

| Cause of death (*International Classification of Diseases,10th Revision* code) | 2021 | | 2022 | | Percent change |
|---|---|---|---|---|---|
| | Deaths | Rate[1] | Deaths | Rate[1] | |
| Congenital malformations (Q00–Q99) | 3,990 | 108.9 | 4,000 | 109.1 | 0 |
| Short gestation and low birthweight, not elsewhere classified (P07) | 2,957 | 80.7 | 2,876 | 78.4 | -3 |
| Sudden infant death syndrome (R95) | 1,458 | 39.8 | 1,458 | 39.8 | 0 |
| Accidents (unintentional injures) (V01–X59) | 1,300 | 35.5 | 1,349 | 36.8 | 4 |
| Maternal complications of pregnancy (P01) | 1,113 | 30.4 | 1,209 | 33.0 | †9 |
| Complications of placenta, cord and membranes (P02) | 663 | 18.1 | 631 | 17.2 | -5 |
| Bacterial sepsis of newborn (P36) | 560 | 15.3 | 637 | 17.4 | †14 |
| Respiratory distress of newborn (P22) | 413 | 11.3 | 458 | 12.5 | 11 |
| Diseases of the circulatory system (I00–I99) | 399 | 10.9 | 358 | 9.8 | -10 |
| Neonatal hemorrhage (P50–P52,P54) | 344 | 9.4 | 336 | 9.2 | -2 |

†Significant change in rate from 2021 to 2022 ($p < 0.05$).
[1]Deaths per 100,000 live births.

SOURCE: National Center for Health Statistics, National Vital Statistics System, linked birth/infant death file.

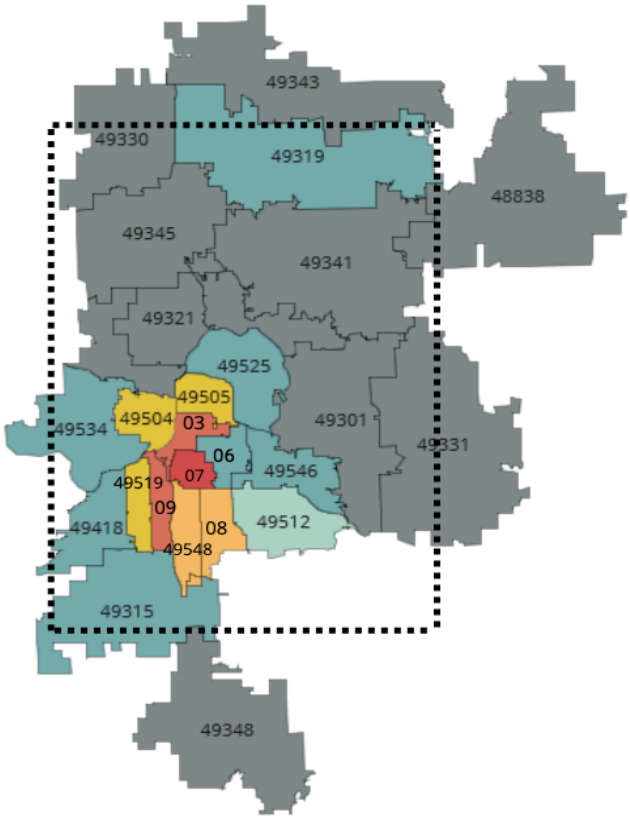
The most recent data about the ten leading causes of death in 2021 and 2022 for infants younger than 365 days of age from the 2023 U.S. "Vital Statistics Surveillance Report" (Ely & Driscoll 2023) is summarized in Figure 3, arranged from the most to the least prevalent of the ten causes. Note that these mortality rates are expressed as infant deaths per 100,000 live births. This table provides aggregated ICD-coded diagnosis classes, the total number of deaths and rates of mortality from each diagnosis for each year, and the percent change for each from 2021 to 2022. As in previous analyses of this data conducted by staff at the National Center for Health Statistics, the results for 2021 are final while those for 2022 were provisional at the time of the report's publication in late 2023. A final report for both years will be released in 2024.

In these two recent years, congenital malformations remained the leading cause of infant mortality nationwide. The rates of death caused by congenital malformations has not changed significantly for some time.

In contrast to the federal report of causes of death for infants who died in their first year across the nation, the Michigan Health and Human Services Department reported: "In 2021, 31% of infants died due to conditions related to prematurity and 15% died due to birth defects. In addition, 10% of infants deaths died due to accidents (sic) and most of these accidents were due to accidental suffocation in bed" (Myer 2023).

**Infant Mortality in Kent County**

Figure 4: Distribution of Infant Deaths in Kent County, Michigan, 2020 (N=180)




**Map code**

Zip codes shaded gray had the lowest rates of death; those shaded red had the highest. Rates were coded in the following color order:

Gray – lowest
Blue
Blue green
Yellow – medium
Light orange
Dark orange
Red - highest

According to Brown, et al. (2022), between 2016 and 2020, 244 infants younger than one year old died in Kent County, an average of nearly 50 (= 48.8) infants each year. The Kent County Fetal Infant Mortality Review Team (KCFIMRT) analyzed recent local infant mortality in "Celebrating More First Birthdays" (Brown et al. 2022 – ultimately studying nearly 75% of these deaths. The geographic distribution within Kent County of the 180 deaths available for the KCFIMRT to analyze is provided in Figure 4 on the previous page.

The Kent County ZIP code with the highest infant mortality rate was 49507 shown in red, with the next highest rates in 49509, 49503, 49508, and 49548.

The KCFIMRT further analyzed these 180 infant deaths, identifying these infant's demographic characteristics and "common factors that may either be present in a case or contributing to the infant's death" (Brown et al. 2022). Some 182 factors were identified, then grouped into the following categories of infant death causation: pre/inter/post conception care; medical: mother; family planning; substance use; prenatal care/delivery: medical: fetal/infant; pediatric care; environment; injuries; social support; partner/father of baby/caregiver; family transition; mental health/stress; family violence/neglect; culture; payment for care; services provided; transportation; and documentation.

When these 180 deaths were examined in terms of race and ethnicity, these additional conclusions **about Black families, mothers, or infants** were included in KCFIMRT's report:[14]

- **Black and Hispanic infants most commonly died of perinatal issues which are most likely attributed to the health of the mother during pregnancy.** White infants most commonly died of congenital anomalies, which are associated with older maternal age or genetic mutations. Overall: 40% of infant deaths were attributed to extreme prematurity or other perinatal issues; 27.8% were due to congenital anomalies; and 12.8% were sleep -related deaths.

- Asian mothers (50%) were most likely to have a late entry into prenatal care. **Black mothers (25.5%) had higher percentages of missed prenatal appointments, and Black mothers (23.4%)** and Other race mothers (27.3%) **were most likely to inappropriately use the ED (Emergency Department) for pregnancy-related care.**

- **42.6% of Black mother's infants were born weighing less than 750 grams,** compared to 31.9% of infants of White mothers; 33.3% of infants of Asian mothers, and 27.3% of infants of Other race mothers. **Black mothers also had the highest percentage (12.8%) of having an infant born with a positive meconium drug test, a result explained as potentially contributed to by the disparity in choosing which mothers to test.**

- While only 11.1% of all mothers had little or no breastfeeding, **Black mothers (21.3%) were almost three times more likely than White mothers (7.7%) to report little or no breastfeeding**.

- When looking at sleeping environments, 14.4% of all infants were placed in a non-infant bed, 8.9% of all infants were sleeping with other people, and 10.6% of infants were placed on soft beds. **Black,** Asian, and Other race **mothers were most likely to bed-share**, **place their infant in a non-infant bed, on a too-soft bed, or not on their back**. Other race mothers (27.3%), **Black mothers (19.1%),** and Asian mothers (16.7%) **had higher percentages of infant suffocation** compared to 7.7% of White mothers and 12% of Hispanic mothers.

- Of the 180 infant death cases reviewed, 45.6% of mothers were single parents, **with Black mothers (68.1%) more likely to be single. Black mothers (38.3%) also had the highest percentages of absent partner support,** while Asian mothers (33.3%) were the most likely to lack family support.

- 40% of mothers whose infants died had a history of mental illness while 24.4% had a mental illness during pregnancy. **Black mothers were more likely to have multiple stressors (42.6%) and social chaos (19.1%)** while Asian mothers reported the highest percentages of concerns about money (50%).

[14] This scoping review does not include all factors and conditions identified by the KCFIMRT. Only factors and conditions related to Black infant mortality are included here, and these are highlighted. The inability of Kent County to analyze more than 25% of the infant deaths that occurred in the period is a threat to this study's validity.

- 7.8% of families who experienced an infant death reported not having access to desired pregnancy-related services, while 3.3% of families were dissatisfied with the services they received. **Black mothers (10.6%)** and Hispanic mothers (12%) were most likely to report unavailable services while Asian mothers (16.7%) were more likely to be dissatisfied with the service.

- 8.9% of families found that transportation was inadequate or unreliable, with **Black mothers (14.9%),** Hispanic mothers (16%), and Asian mothers (16.7%) **the most likely to experience these barriers.**

## MATERNAL MORBIDITY & MORTALITY

"*The maternal mortality crisis in the United States emphasizes the truth behind this declaration: It is racism, not race, that is killing America's Black mothers and babies*."

**Tina Suliman, Johns Hopkins Bloomberg School of Public Health**

Maternal pregnancy outcomes occur on a continuum: normal/healthy pregnancy ⇨ maternal morbidity ⇨ severe maternal morbidity ⇨ maternal mortality or death. Maternal mortality continues to be of great public health importance, however: for each woman who dies as the direct or indirect result of pregnancy, many more women experience the life-threatening complications known as maternal morbidity and severe maternal morbidity (Geller et al. 2018).

The Eunice Shriver Kennedy National Institute of Child Health and Human Development, one of the U.S. National Institutes of Health (NIH), defines "maternal mortality" as the death of a woman from complications of pregnancy or childbirth that occurs during the pregnancy or within six weeks after the pregnancy ends. In contrast, "maternal morbidity" is defined as any short- or long-term health problems that result from being pregnant or giving birth, and "severe maternal morbidity" (SMM) is defined as any severe short- or long-term health problems that arise from being pregnancy or giving birth. Since October 2015, the U.S. Centers for Disease Control and Prevention (as well as U.S. hospitals, state health departments, and other maternal care providers) have used 21 standardized diagnostic indicators—such as cardiac arrest, acute respiratory distress syndrome, acute renal failure, blood transfusion, eclampsia, sepsis, and shock—and their corresponding ICD codes to identify, track, and analyze these often dire diagnoses.[15]

### A global perspective

According to the World Health Organization (WHO 2023), every day in 2020, almost 800 women worldwide died from preventable causes related to pregnancy and childbirth, with a maternal death occurring about every two minutes. About 95% of these deaths occurred in low- and lower middle-income countries that year. Although these women's deaths occurred in the context of a generally improving maternal mortality trend, in the two decades between 2000 and 2020, the global maternal mortality ratio declined by 34%—from 339 to 223 deaths per 100,000

[15] The U.S. CDC's 21 diagnostic indicators of severe maternal morbidity are available here: https://www.cdc.gov/reproductivehealth/maternalinfanthealth/smm/severe-morbidity-ICD.htm

live births (WHO 2023), representing an average rate of reduction of 2.1% in each of the 20 years.

While substantive, this decline in the maternal death rate represents only about one-third of the 6.4% annual rate of decline needed to reach the UN's Sustainable Development Goal (SDG) of 70 maternal deaths per 100,000 live births by 2030. Furthermore, although there was significant progress in reducing the global maternal mortality rate (MMR) between 2000 and 2015, the numbers were stagnant when averaging the increasing mortality ratios reported between 2016 and 2022 in Western Europe and North America, as well as in Latin America and the Caribbean.

**Maternal morbidity & mortality in the United States**

In May 2021, the U.S. House Oversight and Reform Committee held a hearing on racism in Black maternal health care. Among the witnesses were the families of Black mothers who had died giving birth. Congresswoman Cori Bush gave an impassioned speech recounting her own traumatic pregnancy experiences as a Black woman. **"Every day, Black women die because the system denies our humanity,"** Bush said (Suliman 2021).

The U.S. maternal mortality rate is the highest among the world's high-income countries. In fact, pregnancy-related mortality rates doubled between 1987 and 2016 nationwide, while declining in other prosperous nations. Of these maternal deaths, about one-third occurred during pregnancy, one-third at delivery or the week after, and the final third, up to a year postpartum. According to many sources, including the federal government (Petersen 2019), approximately 60% of these maternal deaths were preventable.

Severe maternal morbidity (SMM) affects another 60,000 U.S. women every year. The most common causes of SMM nationwide include procedures in which women receive blood transfusions around delivery, hysterectomy, and ventilation/tracheostomy. These life-threatening complications affect mothers, families, and communities, and cost billions of dollars annually.

According to Johnson et al. (2023): **SMM and maternal mortality disproportionately affect Black women in the U.S., who are three to four times more likely to die of pregnancy-related complications and have twice the SMM rate compared to non-Hispanic white (NHW) women. The recent increase in maternal mortality in the U.S. is particularly substantive among Black women**.

According to a 2023 CDC report (Hoyert 2023) in 2021, 1,205 U.S. women died of maternal causes compared with 861 women in 2020 and 754 women in 2019. The maternal mortality ratio for 2021 was 32.9 deaths per 100,000 live births, compared with a ratio of 23.8 in 2020 and 20.1 in 2019. **But the MMR for Black women was higher still—reaching 69.9 maternal deaths per 100,000 live births—some 2.6 times greater than the 26.6 maternal deaths per 100,000 live births rate for White women in the U.S in this period.** As Chin (2023), Callaghan (2023), and many other researchers have concluded, **Black women are more than twice as likely to die in childbirth or from a pregnancy-related cause compared with their White peers** in the wealthiest nation on earth**.**

**Causes of maternal mortality in the United States**

Trends in maternal mortality in the United States, particularly trends in the deaths of Black women, are not promising.

A recent study by the CDC (Trost 2022) reviewed data on 1,018 pregnancy-related deaths in 36 states across all regions of the nation.[16] **Some 315 (31.9%) of these deaths were those of Black women, a significant disproportionality given the number and percentage of Black residents in these states.** Between 2017 and 2019, when these 1,018 maternal deaths occurred, Blacks comprised approximately 14.2% to 15.76% of the total U.S. population.[17]

Among these 1,018 pregnancy-related deaths, an underlying cause was identified for 987 women. **Cardiac and coronary conditions were the leading (15.2%) causes of pregnancy-related deaths for Black women, claiming 48 lives**; mental health conditions were the leading cause of death among Hispanic and White women, claiming 34 and 159 lives, respectively; and hemorrhage was the leading underlying cause of death among Asian women, claiming 10 lives.[18]

Figure 5 summarizes these findings. As shown, the six most frequent causes of pregnancy-related death—mental health conditions (22.7%), hemorrhage (13.7%), cardiac and coronary conditions (12.8%), infection (9.2%), thrombotic embolism (8.7%), and cardiomyopathy (8.5%) — accounted for over 75% of pregnancy-related deaths; however, the leading underlying causes of death varied by race and ethnicity.

Figure 5: Underlying causes of pregnancy-related maternal deaths*, overall and by race-ethnicity[1] from Maternal Mortality Review Committees in 36 US states, 2017-2019.[1]

[16] Michigan's maternal mortality data was not included in the CDC's analysis or report of conclusions.

[17] A more precise disproportionality estimate would requires determining the proportion of Black residents in the 26 states reporting women's deaths for CDC's analysis: Alabama, Alaska, Arizona, Arkansas, California, Colorado, Connecticut, Delaware, Florida, Georgia, Hawaii, Illinois, Indiana, Kansas, Louisiana, Massachusetts, Minnesota, Mississippi, Missouri, North Carolina, Nebraska, New Hampshire, New Jersey, New Mexico, New York, Ohio, Oklahoma, Oregon, Pennsylvania, Tennessee, Texas, Virginia, Washington, West Virginia, Wisconsin, and Wyoming. Such a calculation was not performed for this scoping review.

[18] The leading causes of pregnancy-related death among American Indian/Alaska Native and Native Hawaiian and other Pacific Islander women were not ranked because of the small populations of these women in this data set.

| | | | | | Non-Hispanic | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Total | | Hispanic | | AIAN | | Asian | | Black | | NHOPI | | White | |
| Condition | N | % | n | % | n | % | n | % | n | % | n | % | n | % |
| Mental health conditions[2] | 224 | 22.7 | 34 | 24.1 | 2 | – | 1 | 3.1 | 21 | 7.0 | 0 | – | 159 | 34.8 |
| Hemorrhage[3] | 135 | 13.7 | 30 | 21.3 | 2 | – | 10 | 31.3 | 33 | 10.9 | 1 | – | 53 | 11.6 |
| Cardiac and coronary conditions[4] | 126 | 12.8 | 15 | 10.6 | 1 | – | 7 | 21.9 | 48 | 15.9 | 0 | – | 49 | 10.7 |
| Infection | 91 | 9.2 | 15 | 10.6 | 1 | – | 0 | 0.0 | 23 | 7.6 | 0 | – | 49 | 10.7 |
| Embolism-thrombotic | 86 | 8.7 | 9 | 6.4 | 0 | – | 2 | 6.3 | 36 | 11.9 | 0 | – | 34 | 7.4 |
| Cardiomyopathy | 84 | 8.5 | 5 | 3.6 | 0 | – | 2 | 6.3 | 42 | 13.9 | 0 | – | 33 | 7.2 |
| Hypertensive disorders of pregnancy | 64 | 6.5 | 7 | 5.0 | 0 | – | 1 | 3.1 | 30 | 9.9 | 1 | – | 22 | 4.8 |
| Amniotic fluid embolism | 37 | 3.8 | 6 | 4.3 | 1 | – | 7 | 21.9 | 10 | 3.3 | 2 | – | 9 | 2.0 |
| Injury[5] | 35 | 3.6 | 5 | 3.6 | 1 | – | 1 | 3.1 | 15 | 5.0 | 0 | – | 10 | 2.2 |
| Cerebrovascular accident | 25 | 2.5 | 2 | 1.4 | 0 | – | 0 | 0.0 | 10 | 3.3 | 0 | – | 13 | 2.8 |
| Cancer | 19 | 1.9 | 3 | 2.1 | 0 | – | 1 | 3.1 | 7 | 2.3 | 0 | – | 7 | 1.5 |
| Metabolic/endocrine conditions | 12 | 1.2 | 2 | 1.4 | 0 | – | 0 | 0.0 | 6 | 2.0 | 0 | – | 3 | 0.7 |
| Pulmonary conditions | 12 | 1.2 | 1 | 0.7 | 0 | – | 0 | 0.0 | 4 | 1.3 | 1 | – | 5 | 1.1 |

Note: AIAN = American Indian or Alaska Native; NHOPI = Native Hawaiian and Other Pacific Islander

[1] Race or ethnicity was missing for 16 (1.6%) pregnancy-related deaths. Deaths among persons classified as non-Hispanic other/multiple races or missing race or ethnicity are included in the total number of deaths.
[2] Mental health conditions include deaths by suicide, overdose/poisoning related to substance use disorder, and other deaths determined by the MMRC to be related to a mental health condition, including substance use disorder.
[3] Hemorrhage excludes aneurysms or cerebrovascular accident (CVA).
[4] Cardiac and coronary conditions include deaths of coronary artery disease, pulmonary hypertension, acquired and congenital valvular heart disease, vascular aneurysm, hypertensive cardiovascular disease, Marfan Syndrome, conduction defects, vascular malformations, and other cardiovascular disease, and excludes cardiomyopathy and hypertensive disorders of pregnancy.
[5] Injury includes intentional injury (homicide), unintentional injury, including overdose/poisoning deaths not related to substance use disorder, and injury of unknown intent or not otherwise specified.

A closer examination of this data shows that **Black women were disproportionately impacted by all but one of the causes of death analyzed**—including experiencing 24.4% of all fatal hemorrhages; 38.09% of fatal cardiac events; 25.3% of fatal infections; 41.9% of fatal embolisms; 50% of fatal cardiomyopathies; 46.9% of the fatal hypertensive disorders of pregnancy; 27% of the fatal amniotic fluid disorders; 42.8% of the fatal injuries; 40% of fatal cerebellar accidents; 36.8% of terminal cancers; 50% of fatal metabolic and endocrine disorders; and 33% of the pulmonary conditions that resulted in death.

In contrast, **Black women were under**represented among the 224 women whose **pregnancy-related deaths were caused by mental health conditions**, which include suicide and substance use-related conditions such as overdoses and accidental poisoning from alcohol

and other substances. **Black women comprised 21 of the 224 (9.4%) of the pregnant women whose deaths were determined to have resulted from a mental health condition.**

After the publication of this study, a considerable amount of attention in the public and professional (medical) media was directed toward pregnancy-related deaths caused by mental health conditions, with less attention focused on the causes of death in Black women or the striking racial disparities this data reveals. For example, in 2023, the Joint Commission, which accredits and certifies more than 22,000 healthcare organizations, including hospitals, across the nation, issued a "Quick Safety Bulletin" with the headline "Mental health conditions leading cause of pregnancy-related deaths," including a paragraph noting these conditions are "the leading underlying cause of death among Hispanic and non-Hispanic White persons," but providing no information about the underlying causes of Black maternal mortality.

The timing of death in relation to the timing of the pregnancy and birth was known for 996 of the women in this study's sample. Approximately 22% of their deaths occurred during pregnancy; 25%, on the day of delivery (within 24 hours of the end of pregnancy) or within a week after delivery; 23%, from 7 to 42 days postpartum; and 30%, in the late postpartum period (43–365 days postpartum). This study also concluded that 839 (84%) of these pregnant women's deaths were "preventable."

**Michigan maternal mortality and morbidity**

A recent dissertation completed the University of Michigan (Kobernik, 2022) provides a useful context for understanding Michigan's current rates of maternal mortality and morbidity:

> *Despite consistent population growth, birth rates in Michigan have consistently decreased since the 1950s, including a decline in teen births. Most of Michigan's population resides in the southern half of the Lower Peninsula, with approximately half of the population residing in Southeast Michigan. Michigan's population is primarily Caucasian (78.9%) and Black or African American (13.9%). Importantly, Detroit has the highest percentage of Black or African American individuals (82.7%) in the country.*
>
> *Michigan's economy improved between 2009-2017, with the unemployment rate decreasing from 12.2% to 4.7%. However, the state still faces significant challenges that impact reproductive-age women. For instance, certain areas of the state continue to experience higher unemployment, such as Keweenaw and Alger counties, with rates of 8.4% and 7.3%, respectively. Additionally, the majority (61%) of jobs in Michigan are low wage jobs, paying less than $20 per hour. Poverty also remains a significant issue, especially for Michigan's children, with approximately 23% of children living in poverty. Of additional concern is that even in households with earnings above the federal poverty level, 40% struggle with basic necessities such as housing, child care, food, health care and transportation. In total, this equates to more than 1.54 million households struggling to meet basic needs in Michigan.*

*Given this environment, family support programs continue to be an important source of assistance. For example, just a third (34.1%) of pregnant persons enrolled in Michigan's Women, Infants, and Children program during their first trimester in 2015, with the vast majority of these individuals living in poverty.*

*It is also getting harder to find hospitals to deliver in Michigan. The number of hospitals that offer obstetrics services has dropped significantly over the past four decades, and rural areas have been severely impacted. Since the 1980's, nearly 100 hospitals have closed in Michigan, with 11 closing since 2008. Just over half of the 6 remaining hospitals across a third of Michigan counties have obstetric units, leaving Michigan mothers in a difficult position. The consequences of travelling farther to get obstetric care range from decreased prenatal visits, a long, hurried, or dangerous drive on delivery day, to premature births, and sometimes death.*

*As of 2018, Michigan is ranked 29th in the nation for maternal deaths, with 19.4 maternal deaths per 100,000 live births. This rate – which has remained unchanged since 2016 – corresponds to approximately 25 Michiganders dying from complications related to pregnancy or childbirth.[19] In addition, for every person who dies in childbirth, 100 more suffer a severe maternal morbidity (SMM) event: a severe life-threatening injury, infection or disease, such as kidney failure, shock, life-threatening blood clots, seizures, and mechanical ventilation. Conditions like these, without prevention or timely treatment, can lead to death. Although the Michigan maternal mortality rate is not extreme compared to other states, its unique geography, changing demographics, and struggling economy are important indicators of the opportunity to improve their statistics.*

*Disparities in Maternal Outcomes*

*Further complicating the discussion of reducing maternal mortality and morbidity is the presence of significant, well-documented racial and socioeconomic disparities.* ***Nationally, Black non-Latina women are three times as likely to die during pregnancy or childbirth and twice as likely as White non-Latina women to experience a SMM event, regardless of underlying risk factors such as obesity and hypertension. Specifically, Detroit has three times the nation's maternal mortality rate with African-American women having a rate three to four times that of any other racial group.*** *This may well be the highest disparity ratio calculated by public health officials, indicating the critical need for evidence-based interventions in Michigan in order to improve health equity.*

*More than 60% of pregnancy-related deaths - deaths while pregnant or within 42 days of termination of pregnancy from any cause related to or aggravated by the pregnancy or its management - in the United States are preventable, with the*

[19] Aggregated data from 2018 through 2021 – a slightly broader timeframe than was available for analysis in this dissertation - shows that Michigan had 83 maternal deaths in that 4-year period and the maternal death rate was identical to the rate reported by Kobernik, 19.40 deaths per 100K pregnancies.

*majority contributed by hemorrhage, cardiovascular and coronary conditions, cardiomyopathy, or infection. However, the leading causes of death vary by race:* ***preeclampsia and eclampsia, and embolism were the leading causes of death for non-Hispanic Black women****, while mental health problems led to more deaths in non-Hispanic White women.* ***No group feels the negative effects of societal and healthcare disparities like Black and African American women****.*

*Race is an important component of socioeconomic status in the United States, capturing economic exploitation, political marginalization, and social stigmatization that makes consequential for virtually every aspect of life, including health. Numerous narratives exist to explain the disparities in maternal mortality and morbidity; however, they are incomplete. Contributors to these trends* ***include the accumulation of stress among African American mothers, limited access to providers and hospitals, provider biases in culturally appropriate counseling, and failure of the health care system to listen to African American women's health concerns.*** **(pp. 4-6)**

Key findings in a recent report on maternal mortality in Michigan by the state's Maternal Mortality Surveillance Program (MDHHS, 2022) underscore Kobernik's conclusions:

- A total of 443 maternal deaths were reported in Michigan from 2015 through 2019, 30 of which were subsequently verified as deaths of mothers who were not pregnant. The revised total for this 5-year period is 413 maternal deaths.
- 77 of these deaths were identified as pregnancy-related.
- The most common causes of pregnancy-related death were hypertensive disorders of pregnancy, hemorrhage, and infection/sepsis.
- 309 deaths were identified as pregnancy-associated, not related.
- The most common cause of pregnancy-associated, not related death were accidental poisoning/drug overdose and medical causes not directly related to or aggravated by the pregnancy.
- 27 deaths had pregnancy-relatedness that was unable to be determined. The most common causes of unable-to-determine deaths were medical, and substance use disorders.
- Disparities existed by race, age, and education level for both pregnancy-related and pregnancy-associated, not related deaths.
- Among the pregnancy-related deaths, 63.6% were determined to be preventable.
- Among the reviewed pregnancy-associated, not related deaths, 68.0%were deemed to be preventable.

In terms of racial disparities in maternal mortality, MDHHS reported that **Black women in Michigan were 2.8 times more likely than White women to die from pregnancy-related causes** (29.8 and 10.7 per 100,000 live births, respectively). Furthermore, **Black women were 1.6 times as likely to die from pregnancy-associated, not related causes compared to White women** (80.9 and 51.1 per 100,000 live births, respectively) in the state.

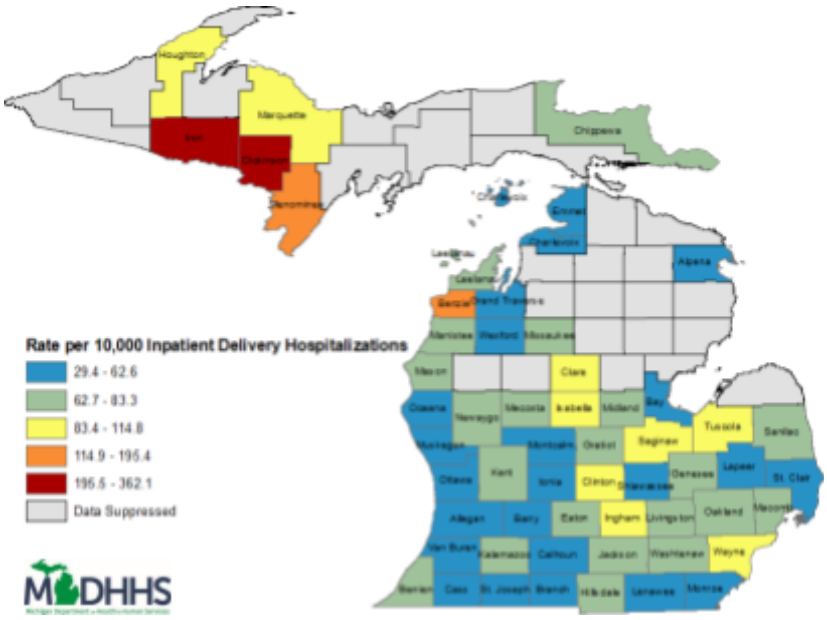
Maternal morbidity is, likewise, of considerable concern across Michigan, as SMM rates have increased statewide over the past 20 years and continued to affect Black women disproportionately: in fact, **Black mothers consistently experienced higher rates of SMM compared to mothers of other races and ethnicities.** From 2019 through 2021, the rate of SMM among Black mothers was twice that of White mothers statewide (Houdeshell-Putt, 2020; MDHHS, 2022).

The most recent map of the geographic distribution of SMM statewide in Michigan from 2017 through 2021 is provided as Figure 6 on the following page.[20]

As shown, Kent County reported between 62.7 and 83.3 instances of SMM per 10,000 in-patient hospital deliveries in this five-year period. This means that Kent was among the counties in the state with the "next to the lowest rates of SMM" statewide. A cursory comparison of SMM rates to the population of counties suggests that, in general, more populous counties in the Lower Peninsula have higher rates of SSM than less populous counties. This is particularly evident in West Michigan, where Kent County is located.

The rates of SMM in the Upper Peninsula appear contrary to observation with Michigan's highest rates of severe maternal morbidity in Iron and Dickinson Counties.

Figure 6: Severe Maternal Morbidity, Michigan, 2017–2021 (MDHHS, 2021)




**Data Note**: The map is based on data from the Michigan Inpatient Database obtained by DHHS with permission from the Michigan Health and Hospital Association Service Corporation. This data does not include the severe

[20] Data for counties with fewer than six cases of SSM were suppressed in this map.

maternal morbidity outcomes for women whose infants were delivered outside of hospitals.

**Innovative Approaches to Reducing Maternal and Infant Mortality & Morbidity**
**The Alliance for Innovation on Maternal Health (AIM)** is a quality improvement initiative working to make birth safer, improve maternal health outcomes, and save lives. AIM publishes maternal safety bundles of evidence-based practices and institutional guidelines. The AIM bundles, implemented through the nation's perinatal quality collaboratives (described below), include five domains: readiness, recognition and prevention, response, reporting and systems learning, and most recently added, respectful care, which has a focus on equity and inclusion. These safety bundles comprise evidence-based collections of recommendations intended to be adapted to the needs of each perinatal quality collaborative using the quality-improvement (QI) methodologies that members of a collaborative have chosen as most appropriate for its maternal population.
According to AIM, a "bundle" is a small set of evidence-based interventions that combines medical and improvement science to achieve improved outcomes. Maternal safety bundles have demonstrated the ability to successfully improve outcomes and **reduce racial gaps** through structured, actionable steps for implementing evidence-based practices. In California, for example, maternal mortality rates decreased and SMM racial disparities were reduced after implementation of an obstetric hemorrhage maternal safety bundle; significantly, this drop was contrasted to a rise in national rates of maternal mortality from hemorrhage during the same period.
In Pennsylvania, a health system implemented a project to achieve an equity-focused goal of reducing Black maternal mortality in five hospital sites by forming a data-driven QI collaborative to address racial inequities through evidence-based practices. Davidson et al. similarly sought to achieve a decline in SMM and SMM-related racial disparities through a Houston hospital's implementation of safety bundles after data disaggregated by race and ethnicity were presented at department meetings, even before other bundle interventions and measures were implemented in the institution. These findings suggest that calling attention to racial gaps in SMM could: steer medical care teams toward improvement, aid in decreasing racial inequities in maternal mortality and SMM, and highlight the importance of defining measures to target improvements.

A specific set of AIM "Community Care Bundles" was recently developed by the AIM Community Care Initiative (CCI) for use in non-hospital settings, such as outpatient and community-based clinical facilities, as well as by other social and supportive services agencies that may be touchpoints during a woman's pregnancy and postpartum journey.

These new AIM CCI bundles are based on the following assumptions:

- When care processes are grouped into simple bundles, caregivers are more likely to implement them by making fundamental changes in how their work is done—that is, what services are delivered and how they are delivered;

- When the care processes are evidence based, maternal and infant outcomes will improve; and,

- Bundling encourages interdisciplinary teams to organize their work, adapt the delivery system to women's needs, and deliver bundle components reliably.

The five AIM CCI bundles available (as of November 30, 2023), include: Community Care for Postpartum Safety and Wellness; Community Care for Maternal Mental Health & Wellness; Community Care to Address Intimate Partner Violence During and After Pregnancy; and Community Care to Address Chronic Conditions During Pregnancy. A comprehensive description of each CCI bundle and its medical and comprehensive community care components is available at https://www.aimcci.org/bundles/.

**The Kent County, MI, Clinical Trial of CCI Bundles: The MIRACLE Project**

Kent County is one of just six communities nationally (and the only community in Michigan) piloting AIM-CCI's equity-focused community care maternal safety bundles as they are developed by the national organization. In a clinical trial-focused collaboration with AIM-CCI, Kent County healthcare providers will implement two AIM CCI bundles each year for four years within outpatient clinical settings and community-based organizations. In addition, similar settings and organizations in Genesee County are implementing these bundles in partnership with Kent County.

This clinical trial, now underway, is known as the Maternal Health Multilevel Intervention for Racial Equity (Maternal Health MIRACLE) Project. The study design uses a quasi-experimental difference-in-differences (DiD) with propensity scores approach to compare changes in outcomes among Medicaid-insured women in Kent and Genesee counties with similar women in other Michigan counties, using data from the period before implementation (2016–2019) and comparable data from the period after implementation (2022–2025) on the outcomes of interest. The proposed study sample is all Medicaid-insured deliveries in Michigan from 2016–2019 and 2022–2025 (comprising ~540,000 births, including ~162,000 births to African American women).

The aims of this research in Kent County are to:

1. Assess the effectiveness of the multilevel intervention on:

    a. African American SMM and a composite of SMM and pregnancy-related mortality (overall & relative to non-Hispanic White women), and

    b. African American, non-severe maternal morbidity (overall & relative to non-Hispanic White women).

2. Test-improved service utilization and non-severe maternal morbidity (overall and relative to NHW women) as mechanisms (i.e., mediators) of the intervention's effect on SMM.

3. Evaluate the cost-effectiveness of the AIM CCI intervention bundles.

As described by Johnson et al. (2022), this research is among the first to examine the effects of a multilevel intervention on African American Severe Maternal Morbidity and Mortality, and the first to test this specific multilevel intervention. Novel aspects of the clinical trial include its rigorous quasi-experimental design, use of interventions at each level that were developed or co-developed by community partners in previous experimental counties, assessment of intervention effects using population-level data, and use of a unique statewide database system to assess study outcomes.

Examples of the bundles planned for implementation in Kent and Genesee counties include "transition from maternity care to well-woman care," "comorbidities," and "maternal mental health." The first bundle to be implemented was "postpartum care basics for maternal safety." It consisted of county-wide efforts to: (1) create pathways for systematic referral of all Medicaid-eligible pregnant women to EPC services; and (2) use the CDC's Hear Her® program (described below), which identifies maternal and infant warning signs and appropriate responses for healthcare and social service providers, pregnant women, staff, family members, friends, and others in the community.

The national AIM CCI study team is partnering with Kent County's implementation team to bring implementation science expertise to this clinical trial process. Complete details of the Maternal Health MIRACLE clinical trial are available from the National Library of Medicine online at https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9809987/.

**Other actions and advocacy initiatives in response to Black maternal and infant mortality and morbidity disparities in the U.S.**

Many additional initiatives have been implemented recently to reduce Black maternal and infant mortality and morbidity in the U.S.

For example, Hear Her®, launched nationwide in 2022, is a public information campaign designed by the CDC to prevent pregnancy-related deaths by promulgating potentially life-saving messages about urgent maternal "warning signs" that may indicate that a mother or infant's life is at risk. A partnership between the CDC Foundation and Merck Pharmaceutical's "Merck for Mothers Program," Hear Her® encourages pregnant women's healthcare and social service providers, partners, friends, family members, and co-workers to purposefully listen and then take action when a pregnant woman tells them something doesn't feel quite right.

As Dr. Wanda Barfield, Director of CDC's Division of Reproductive Health, points out: "*A person knows their body best. Listening and acting upon their concerns during or after a pregnancy could save a life"* (CDC, 2022).

Photographs on the Hear Her® website feature Black, American Indian, and Alaska Native women, as well as much of the other resources are culturally relevant for diverse women in these communities. These resources include campaign materials for healthcare professionals; videos of women's real stories and experiences; media resources, including press releases and public service announcements (PSAs); social media posts; shareable graphics for websites, blogs and social networking sites; posters and handouts; and microsite and syndicated content for free use

on an organization's or individual's website. Local health departments can co-brand or localize these materials in collaboration with the overall campaign.

As previously noted, elements of the Hear Her® campaign are currently an integral part of the Maternal Health MIRACLE Clinical Trial now underway in Kent and Genesee County.

Other notable recent scholarship and advocacy efforts include:

- Formation of the **Black Mamas Matter Alliance** (BMMA), a Black women-led, cross-sectoral alliance that centers Black women and other birthing people to advocate, drive research, build power, and shift culture for Black maternal health, rights, and justice. Headquartered in Atlanta, Georgia, BMMA's goals include changing policies, cultivating research, advancing care for Black women, and reframing the conversation on Black maternal health and amplifying the voices of Black mothers. More information on the strategies and tactics being deployed by BMMA is available at http://www.blackmamasmatter.org.

- **Improvements in national pregnancy-related mortality surveillance** to better monitor and understand the risk factors for and causes of pregnancy-related deaths in the United States have been made at the federal, state, and county level. For example, the CDC's **Enhancing Reviews and Surveillance to Eliminate Maternal Morbidity (ERASE MM)** initiative supports agencies and organizations working to improve the coordination and management of Maternal Mortality Review Committees to identify, review, and characterize maternal deaths; and to identify prevention opportunities. The newest reviews and regularly updated surveillance data are available at https://www.cdc.gov/reproductivehealth/maternal-mortality/erase-mm/index.html. Michigan is among the states receiving ERASE MM funding.

- **Perinatal Quality Collaboratives (PQCs)** are state or multi-state networks of teams working to improve the quality of care for mothers and babies. PQC members identify health care processes that need to be improved and use the best available methods to make changes as quickly as possible. Henderson et al. (2018) provides a useful discussion about the development and impacts of this initiative, which provides a theoretical grounding for the AIM CCI work.

- **The Levels of Care Assessment Tool (LOCATe)** is a new web-based tool developed by the CDC to help states and other jurisdictions create standardized assessments of levels of maternal and neonatal care. Additional information and the instrument are available at https://www.cdc.gov/reproductivehealth/maternalinfanthealth/cdc-locate/index.html.

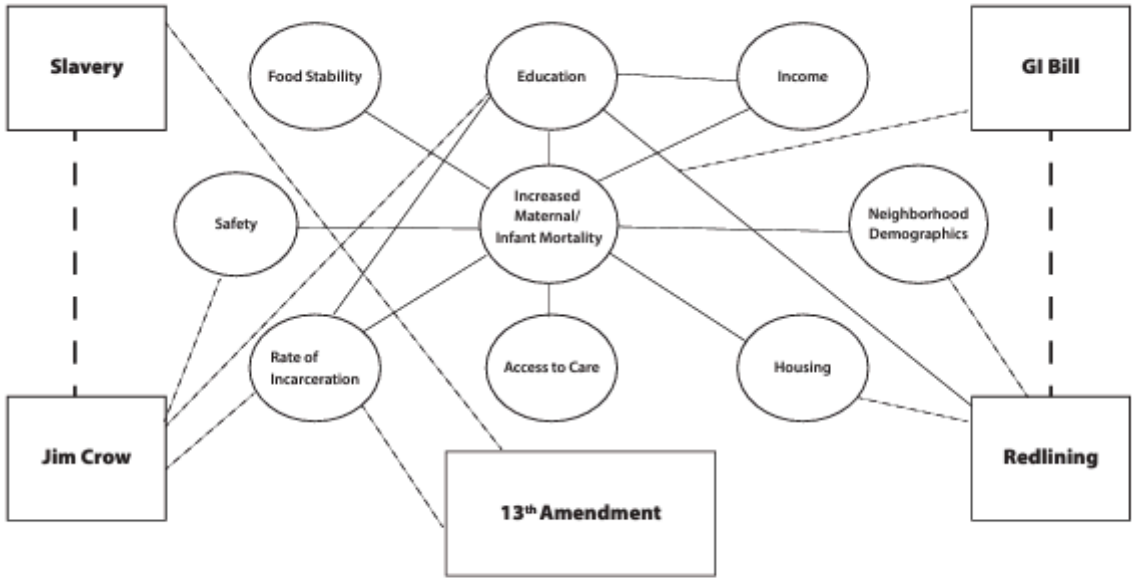
- "**State Strategies for Preventing Pregnancy-Related Deaths: A Guide for Moving Maternal Mortality Review Committee (MMRC) Data to Action"** is an updated federal guide for facilitating the implementation of data-informed strategies to prevent pregnancy-related deaths (CDC 2022). This 87-page document focuses primarily on addressing the health inequities that impact Black pregnant women; it also includes strategies for improving American Indian and Alaska Native women's pregnancy

outcomes.

This guide is particularly notable for its incorporation of Roach's theoretical model and framework examining the "web of causation between the structural and social determinants of Black maternal health" (p. 19). A recent work by Crear-Perry et al. (2021) also makes significant use of Roach's theoretical framework, including an even-more thorough analysis of the social and structural determinants of the numerous health inequities impacting maternal and infant health.

The pragmatic framework developed by Roach (2016) is shown as Figure 7 on the page following.

Figure 7: The "Web of Causation" based on the *Restoring Our Own Through Transformation* (*ROOTT) Model of Increased Maternal & Infant Mortality* (Roach, 2016)




In this conceptual model, the structural determinants of maternal and infant health are depicted in *boxes* connected by *dashed lines*, which shape the distribution of the social determinants of health, which are depicted by *circles* and connected by *solid lines*. The multiple and interconnected pathways between structural and social determinants led to increased maternal and infant mortality rates and socially defined inequities in both outcomes, as well as in increased rates of maternal and infant morbidity.

According to Crear-Perry's related analysis of this approach:

*This framework identifies the social determinants of Black maternal health—education, income, neighborhood characteristics, housing, access to care, safety, and food stability—and how their availability to Black families has been dictated by the very structure of American society from the time of slavery. . . .*

*Structural racism and institutional policies and practices—Jim Crow, the GI Bill, "redlining" (home mortgage denial on the basis of race and government-backed disinvestment in non-White neighborhoods), mass incarceration—are historically based features of an overtly oppressive U.S. society that have endured and adapted over time and continue to shape contemporary access to health-promoting resources and opportunities necessary for optimal Black maternal and infant health outcomes. Work that seeks to further elucidate the web of causation between the structural and social determinants of health for Black women and other disenfranchised groups has the potential to facilitate the identification of interventions and policies that can remediate and eliminate inequalities in health across the population . . . .*

***Identifying the root causes of maternal mortality, remediating factors that may be contributing to its increasing incidence, and eliminating the disproportionate burden of loss among families of color is an imperative for this nation's future.*** *The immense economic costs of maternal morbidity and mortality may justify action among those unmoved by population health promotion and equity alone. Data suggest the economic burden of maternal morbidity and mortality is billions of dollars each year. Beyond the 700–900 women who suffer from pregnancy complications that result in death, an additional 60,000 women suffer pregnancy-related complications that are near fatal. In particular, the cost of caring for women with preeclampsia is more than $1 billion alone, and the prevailing total annual cost of maternity care exceeds $60 billion.*

*As the scientific community continues to identify the structural determinants of maternal health inequities and recommend policies to address them, improvements in equitable access to the SDOH and reduction of health inequities are likely to follow. This move to advance upstream structural solutions is critical for families to thrive.* ***By defining the root causes of health inequities, we can move the focus of intervention away from individual blame and misguided theories of the biological basis of race and ethnicity*** [emphasis added]. *The shared understanding of how inequities in outcomes based upon race, class, and gender are created by policy and practice is pivotal to ending these inequities. It is an economic, social, and moral imperative that we center the experience of the communities that are the most impacted when we look for solutions, because they hold the answers to improving delivery of respectful care and ensuring reproductive health and well-being for all.*

## SOURCES CITED


Alliance for Innovation on Maternal Health. Measurement of respectful care in AIM statements. Accessed online October 21, 2023: https://saferbirth.org/wp-content/uploads/2021_10_21-Statement-on-Measurement-of-Resepctful-Care-in-AIM_.pdf

Brown, M, Hall, M, Berry, B, Tallman, S. Celebrating more first birthdays: An analysis of infant death in Kent County, Michigan, 2022. Kent County Health Department. Accessed online October 19, 2023: https://content.govdelivery.com/attachments/KENTCOMI/2023/01/17/file_attachments/2381810/Annual%20FIMR%20Report%20%28Public%29.pdf.

Callaghan WM, Creanga AA, Kuklina EV. Severe maternal morbidity among delivery and postpartum hospitalizations in the United States. *Obstetrics and Gynecology* 2012;120:1029–36. doi: 10.1097/aog.0b013e31826d60c5.

Chmielewska B, Barratt I, Townsend R, Kalafat E, van der Meulen J, Gurol-Urganci I, O'Brien P, Morris E, Draycott T, Thangaratinam S, Le Doare K, Ladhani S, von Dadelszen P, Magee L, Khalil A. Effects of the COVID-19 pandemic on maternal and perinatal outcomes: a systematic review and meta-analysis. Lancet Global Health. 2021 Jun;9(6): e759-e772. doi: 10.1016/S2214-109X(21)00079-6. Epub 2021 Mar 31. Erratum in: Lancet Glob Health. 2021 Jun;9(6):e758. PMID: 33811827; PMCID: PMC8012052.

Crear-Perry J, Correa-de-Araujo R, Lewis Johnson T, McLemore MR, Neilson E, Wallace M. Social and Structural Determinants of Health Inequities in Maternal Health. Journal of Women's Health (Larchmt). 2021; 30(2):230-235. doi: 10.1089/jwh.2020.8882. Epub 2020 Nov 12. PMID: 33181043; PMCID: PMC8020519.

Ely DM, Driscoll AK. Infant mortality in the United States: Provisional data from the 2022 period linked birth/infant death file. National Center for Health Statistics.Vital Statistics Rapid Release; no 33. Hyattsville, MD: National Center forHealth Statistics. 2023. DOI: https://doi.org/10.15620/cdc:133699.

Chinn JJ, Eisenberg E, Artis Dickerson S, King RB, Chakhtoura N, Lim IAL, et al. Maternal mortality in the United States: research gaps, opportunities, and priorities. American Journal of Obstetetrics and Gynecology, 2020;223:486–92.e6. doi: 10.1016/j.ajog.2020.07.021

Geller, S.E., Koch, A.R., Garland, C.E. A global view of severe maternal morbidity: moving beyond maternal mortality. *Reproductive Health* , 2018, **15** (Suppl 1), 98. Accessed online: https://doi.org/10.1186/s12978-018-0527-2

Grant MJ, Booth A. A typology of reviews: an analysis of 14 review types and associated methodologies. Health Information Library Journal. 2009;26(2):91–108. doi: 10.1111/j.1471-1842.2009.00848.x.

Hardeman RR, et al. Developing Tools to Report Racism in Maternal Health for the CDC Maternal Mortality Review Information Application (MMRIA): Findings from the MMRIA Racism & Discrimination Working Group. Maternal and Child Health Journal. 2022 Apr;26(4):661-669.

Henderson ZT, Ernst K, Simpson KR, Berns SD, Suchdev DB, Main E, McCaffrey M, Lee K, Rouse TB, Olson CK. The National Network of State Perinatal Quality Collaboratives: A Growing Movement to Improve Maternal and Infant Health. Journal of Women's Health (Larchmt). 2018 Feb;27(2):123-127. doi: 10.1089/jwh.2017.6844. Epub. 2018 Feb 1. PMID: 29389242.

Houdeshell-Putt, Laura, "Severe Maternal Morbidity in Michigan: An Investigation of Health Disparities" (2020). *Walden Dissertations and Doctoral Studies*. 8732. Accessed online: https://scholarworks.waldenu.edu/dissertations/8732.

Howell EA, Janevic T, Hebert PL, Egorova NN, Balbierz A, Zeitlin J. Differences in morbidity and mortality rates in black, white, and Hispanic very preterm infants among New York City hospitals. *JAMA Pediatrics,* 2018;172(3):269–277. doi:10.1001/jamapediatrics.2017.4402

Hoyert DL. Maternal mortality rates in the United States, 2021. NCHS Health E-Stats. 2023. DOI: https://dx.doi.org/10.15620/cdc:124678.

Howell EA, Ahmed ZN. Eight steps for narrowing the maternal health disparity gap: step-by-step plan to reduce racial and ethnic disparities in care. Contemporary Obstetrics and Gynecology 2019;64:30–6. doi: 10.123

Johnson JE, Roman L, Key KD, Meulen MV, Raffo JE, Luo Z, Margerison CE, Olomu A, Johnson-Lawrence V, White JM, Meghea C. Study protocol: The Maternal Health Multilevel Intervention for Racial Equity (Maternal Health MIRACLE) Project. Contemporary Clinical Trials. 2022 Sep; 120:106894. doi: 10.1016/j.cct.2022.106894. Epub 2022 Aug 24. PMID: 36028193; PMCID: PMC9809987.

Accessed online November 26, 2023: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9809987/.

Joint Commission. Mental health conditions leading cause of pregnancy-related deaths. Quick Safety, Issue 67. Accessed online October 24, 2023: https://www.jointcommission.org/-/media/tjc/newsletters/quick-safety-67-maternal-death-and-mh-1-13-23-final.pdf

Kheyfets A, Vitek K, Conklin C, Tu C, Larson E, Zera C, Iverson R, Reiff E, Healy A, Lauring J, Schoen C, Manganaro K, Pomerleau M, Glass B, Amutah-Onukagha N, Diop H, Meadows AR. Development of a Maternal Equity Safety Bundle to Eliminate Racial Inequities in Massachusetts. Obstetrics and Gynecology. 2023 Oct 1;142(4):831-839. doi: 10.1097/AOG.0000000000005322. Epub 2023 Sep 7. PMID: 37734090; PMCID: PMC10510776.

Lee King PA, Henderson ZT, Borders AEB. Advances in Maternal Fetal Medicine: Perinatal Quality Collaboratives Working Together to Improve Maternal Outcomes. Clinical Perinatology. 2020 Dec;47(4):779-797. doi: 10.1016/j.clp.2020.08.009. Epub 2020 Oct 16. PMID: 33153662.

Kobernik, EK. Reducing Maternal Mortality and Morbidity in Michigan: A Mixed Methods Analysis of the Impact of an Obstetric Hemorrhage Patient Safety Bundle. A dissertation submitted in partial fulfillment of requirements for the Doctor of Philosophy degree (Health Infrastructures and Learning Systems) at the University of Michigan, 2022. Accessed online, November 4, 2023: https://deepblue.lib.umich.edu/bitstream/handle/2027.42/174377/kobernik_1.pdf?sequence=1&isAllowed=y

Myers, L. Summary of 2021 infant death statistics. Division of Vital Records & Health Statistics. Michigan Department of Health & Human Services, November 2022. Accessed October 28, 2023: https://vitalstats.michigan.gov/osr/InDxMain/Infsum05.asp.

Michigan Department of Health & Human Services (MDHHS). Maternal deaths in Michigan, 2015-2019 Data Update, Michigan Maternal Mortality Surveillance (MMMS) Program. Accessed online October 17, 2023: https://www.michigan.gov/mdhhs/-/media/Project/Web.

Michigan Department of Health and Human Services, Michigan Resident Inpatient Files created by the Division for Vital Records and Health Statistics. (MDHHS) using data from the Michigan Inpatient Database obtained with permission from the Michigan Health and Hospital Association Service Corporation (MHASC

Munn Z, Stern C, Aromataris E, Lockwood C, Jordan Z. What kind of systematic review should I conduct? A proposed typology and guidance for systematic reviewers in the medical and health sciences. BMC Medical Research Methodology. 2018; 18(1):5. doi: 10.1186/s12874-017-0468-4.

National Center for Health Statistics (US). Health, United States, annual perspective, 2020-2021. National Center for Health Statistics (US); 2023. doi: 10.15620/cdc:122044

National Institutes of Health. Office of Research on Women's Health. *Maternal morbidity and mortality: What do we know? How are we addressing it.* 2019. Accessed online October 22, 2023: https://orwh.od.nih.gov/sites/orwh/files/docs/ORWH_MMM_Booklet_508C.pdf.

Osterman, MJK, Hamilton, BE, Martin, JA, Driscoll, AK, Valenzuela, CP. Births: final data for 2020. US Centers for Disease Control and Prevention. National Vital Statistics Reports, February 7, 2022: vol. 70:17. Accessed online: October 22, 2023:https://stacks.cdc.gov/view/cdc/112078.

Owens DC, Fett SM. Black Maternal and Infant Health: Historical Legacies of Slavery. American Journal of Public Health. 2019 Oct;109(10):1342-1345. doi: 10.2105/AJPH.2019.305243. Epub 2019 Aug 15. PMID: 31415204; PMCID: PMC6727302.

Peters MD, Godfrey CM, Khalil H, McInerney P, Parker D, Soares CB. Guidance for conducting systematic scoping reviews. International Journal of Evidence Based Healthcare. 2015;13(3):141–146. doi: 10.1097/XEB.0000000000000050.

Petersen EE, Davis NL, Goodman D, Cox S, Mayes N, Johnston E, Syverson C, Seed K, Shapiro-Mendoza CK, Callaghan WM, Barfield W. Vital Signs: Pregnancy-Related Deaths, United States, 2011-2015, and Strategies for Prevention, 13 States, 2013-2017. MMWR Morbidity and Mortality Weekly Report. 2019 May 10;68(18):423-429. doi: 10.15585/mmwr.mm6818e1. PMID: 31071074; PMCID: PMC6542194.

Roach J. ROOTT's theoretical framework of the web of causation between structural and social determinants of health and wellness—2016. Restoring Our Own Through Transformation (ROOTT), 2016. Accessed December 4, 2023: https://www.roottrj.org/policy-advocacy.

Scommegna, P. (2021, January 21). High premature birth rates among U.S. black women may reflect the stress of racism and health and economic factors. PRB. Retrieved October 23, 2023: https://www.prb.org/resources/high-premature-birth-rates-among-u-s-black-women-may-reflect-the-stress-of-racism-and-health-and-economic-factors/

Suliman, T. Blact maternal mortality: "It's racism, not race." John Hopkins Center for Communication Programs. Accessed online November 4, 2023: https://ccp.jhu.edu/2021/05/17/maternal-mortality-black-mamas-race-momnibus/.

Thoma ME, Declercq ER. Changes in pregnancy-related mortality associated with the coronavirus disease 2019 (COVID-19) pandemic in the United States. Obstetrics and Gynecology, 2023; 141:911–7. doi: 10.1097/AOG.0000000000005182.

Trost SL, Beauregard J, Njie F, et al. Pregnancy-Related Deaths: Data from Maternal Mortality Review Committees in 36 US States, 2017–2019. Atlanta, GA: Centers for Disease Control and Prevention, US Department of Health and Human Services; 2022.

United Nations. World Population Prospects. Accessed online October 28, 2023: <ahref='https://www.macrotrends.net/countries/WLD/world/birth-rate'>World Birth Rate 1950-2023</a>. www.macrotrends.net.

United States Centers for Disease Control and Prevention (U.S. CDC). 2022. Reproductive Health, Pregnancy Mortality Surveillance System. Accessed November 2023: https://www.cdc.gov/reproductivehealth/maternal-mortality/pregnancy-mortality-surveillance-system.htm.

United States Centers for Disease Control and Prevention (U.S. CDC). 2022. State Strategies for Preventing Pregnancy-Related Deaths: A Guide for Moving Maternal Mortality Review Committee Data to Action. Atlanta, GA. Accessed online: November 29, 2023: www.cdc.gov/reproductivehealth/maternal-mortality/docs/pdf/State-Strategies-508.pdf.

United States Centers for Disease Control and Prevention. (U.S. CDC). Hear Her Campaign. Accessed online November 30, 2023: https://www.cdc.gov/hearher/index.html.

Valerio VC, Downey J, Sgaier SK, Callaghan WM, Hammer B, Smittenaar P. Black-White disparities in maternal vulnerability and adverse pregnancy outcomes: an ecological population study in the United States, 2014-2018. Lancet Reg Health Am. 2023 Apr 3;20:100456. doi: 10.1016/j.lana.2023.100456. PMID: 37095772; PMCID: PMC10122115.

Woodbury, RM. The trend of maternal-mortality rates in the United States death-registration area, 1900-1921. The American Journal of Public Health. 1924. Accessed November 5, 2023: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1354988/pdf/amjphealth00049-0004.pdf.

World Health Organization, UNICEF, United Nations Population Fund and The World Bank, *Trends in Maternal Mortality: 2000 to 2020* WHO, Geneva, 2023. Accessed online October 20, 2023: https://data.unicef.org/topic/maternal-health/maternal-mortality/.

**Sources Reviewed but Not Cited**

Black Women Scholars, Research Working Group for Black Mamas Matter Alliance. Black maternal health research re-envisioned: Best practices for the conduct of research with, for, and by Black mamas. Harvard Policy and Law Review, 2020;14,2. Accessed online: November 20, 2023:
https://journals.law.harvard.edu/lpr/wp-content/uploads/sites/89/2020/11/BMMA-Research-Working-Group.pdf.

Burris, H. H., & Hacker, M. R. Birth outcome racial disparities: A result of intersecting social and environmental factors. Seminars in perinatology, 2017. 41(6), 360–366. https://doi.org/10.1053/j.semperi.2017.07.002

Debbink M.P., Bader M.D.M. Racial residential segregation and low birth weight in Michigan's metropolitan areas. American Journal of Public Health. 2011; 101:1714–1720. Accessed online October 30, 2023: https://ajph.aphapublications.org/doi/full/10.2105/AJPH.2011.300152.

Driscoll, A. K., & Ely, D. M. Effects of Changes in Maternal Age Distribution and Maternal Age-Specific Infant Mortality Rates on Infant Mortality Trends: United States, 2000-2017. June 25, 2020. Retrieved October 29, 2023:
https://www.cdc.gov/nchs/data/nvsr/nvsr69/NVSR-69-05-508.pdf.

Hamilton BE, Martin JA, Osterman MJK. Births: Provisional data for 2020. Vital Statistics Rapid Release; no 12. Hyattsville, MD: National Center for Health Statistics. May 2021. https://www.cdc.gov/nchs/data/vsrr/vsrr012-508.pdf.
Hamilton BE, Osterman MJK, Martin JA. Declines in births by month: United States, 2020. Vital Statistics Rapid Release; no 14. Hyattsville, MD: National Center for Health Statistics. June 2021.

Lewis JA. Contributions of Black psychology scholars to models of racism and health: Applying intersectionality to center Black women. American Psychologist. 2023 May-Jun;78(4):576-588. doi: 10.1037/amp0001141. PMID: 37384509.

Lu MC, Halfon N. Racial and ethnic disparities in birth outcomes: a life-course perspective. Maternal and Child Health Journal. 2003;7(1):13–30. Accessed online November 3, 2023.

Martin JA, Hamilton BE, Osterman MJK. Births in the United States, 2020. NCHS Data Brief, no 418. Hyattsville, MD: National Center for Health Statistics. 2021.

Martin JA, Hamilton BE, Osterman MJK, Driscoll AK. Births: Final data for 2019. National Vital Statistics Reports; vol 70 no 2. Hyattsville, MD: National Center for Health Statistics. 2021. https://www.cdc.gov/nchs/data/nvsr/nvsr70/nvsr70-02-508.pdf.

National Center for Health Statistics. Provisional estimates for selected maternal and infant outcomes by month,
2018–2021.https://www.cdc.gov/nchs/covid19/technical-notes-outcomes.htm.

Scott KA, Britton L, McLemore MR. The Ethics of Perinatal Care for Black Women: Dismantling the Structural Racism in "Mother Blame" Narratives. Journal of Perinatal and Neonatal Nursing. 2019 Apr/Jun; 33(2):108-115. doi: 10.1097/JPN.0000000000000394. PMID: 31021935.

U.S. Census Bureau. 2020 population estimates. Annual state resident population estimates for 6 race groups (5 race alone groups and one multiple race group) by age, sex, and Hispanic origin: April 1, 2010, to July 1, 2020. 2021. https://www2.census.gov/programs-surveys/popest/datasets/2010-2020/state/asrh/SC-EST2020-ALLDATA6.csv.

Ventura SJ, Bachrach CA. Nonmarital childbearing in the United States, 1940–99. National Vital Statistics Reports; vol 48 no 16. Hyattsville, MD: National Center for Health Statistics. 2000.